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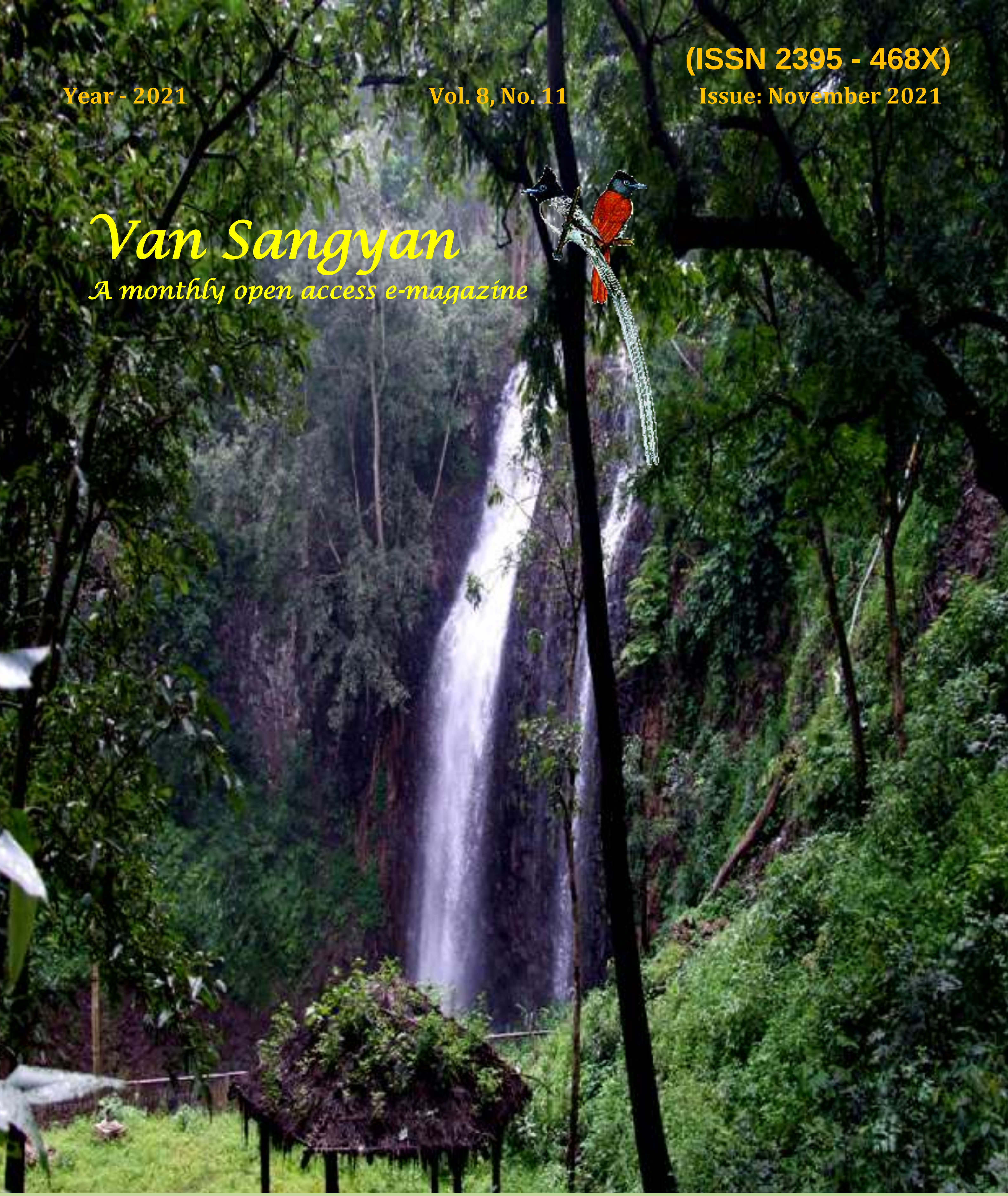

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Van Sangyan

Note to Authors:

We welcome the readers of Van Sangyan to write to us about their views and issues in forestry. Those who wish to share their knowledge and experiences can send them:

by e-mail to vansangyan_tfri@icfre.org

or, through post to The Editor, Van Sangyan,
Tropical Forest Research Institute,
PO-RFRC, Mandla Road,
Jabalpur (M.P.) - 482021.

The articles can be in English, Hindi, Marathi, Chhattisgarhi and Oriya, and should contain the writers name, designation and full postal address, including e-mail id and contact number.

TFRI, Jabalpur houses experts from all fields of forestry who would be happy to answer reader's queries on various scientific issues. Your queries may be sent to The Editor, and the expert’s reply to the same will be published in the next issue of Van Sangyan.

Cover Photo: Panoramic view of Achanakmar-Amarkantak Biosphere Reserve
Photo credit: Dr. N. Roychoudhury and Dr. Rajesh Kumar Mishra, TFRI, Jabalpur (M.P.)

From the Editor's desk

Henna plant, one of the most well known and used botanicals on earth, is known by its Latin names of Lawsonia inermis, L.alba, L.spinosa, and L.ruba and is commonly known today by the Indian name Mehndi. Henna will dye many colours naturally and fresh henna leaves create vibrant red mehndi body art designs. The ancient Arabic name for Henna or Hinna given to Lawsonia inermy or the mignonette is by far the most used and well known of all of the names. 'Hinna', originally is believed to be given by Arabic speaking Persians. The ancient Egyptian hieroglyphic name for henna is thought to be "Henu" and in Farsi, henna is known as "Hina" (Henna is taken from Hina). In India, henna plant is referred to as "Mehndi" because "Mindi" or "Mehndi", coming from ancient Sanskrit, especially in the Rajasthan area, means myrtle. The Henna plant is regarded as a gift to India from Egypt where they painted their fingernails along with it. Though there is evidence that it absolutely was there centuries before, some state it came to Asia through Iranian lands.

Some researchers argue that henna descends from ancient Asia while other people claim it had been brought to India by Egyptian Moghuls in the century C.E that is 12th. Nevertheless, others said that the tradition of applying henna started in East and North Africa in ancient times.

It's thought that Mehandi was only for sale in the deserts of Asia as the local people there found that colouring their fingers and base of hands with paste prepared from the Henna plant assisted them to feel cooler. Eventually, brides began to embellish their foot and arms with henna incorporated into their wedding rituals. There are myths that an Egyptian queen was the first to discover henna as a hair colorant while sitting next to the Nile some 3000 years ago. Researchers believe henna use existed for a much longer time in that area. The most popular application for henna is as a hair-colorant. Henna hair dye stimulates growth and prevents baldness in both men and women. Women use it precisely for their hair, whereas men use it for hair as well as beard. Henna has the ability to absorb oil from the hair, rendering oily hair to a more dryer, normal state. Various parts of the henna plants are used for various purposes. The bark was used to calm people and is known for its astringent qualities. It was also specifically used for jaundice, leprosy, and enlargement of the spleen. The seeds or berries can be used to make deodorant and cures weakness. The flowers cool the body and help with sleep. Henna cures headaches caused by the heat of the sun as it provides a cooling effect and it was used as a sunscreen in ancient times to protect people from the UV rays. Henna hair color helps to regrow hair and makes it longer and stronger. Henna can be used with various Indian herbs such as amla powder, shikhakai powder, indigo powder, reethi powder, tulsi powder, neem powder, multani mitti etc. which add to the benefits of henna powder.

In line with the above this issue of Van Sangyan contains an article on Henna- The colouring herb of dry land areas. There are also useful articles viz. Rajasthan Forest, Radioactive contamination: Environmental issues, Role of fuelwood and its substitute's and Occurrence of Ophiusa tirhaca in sal forests of Kanha Tiger Reserve.

I hope that readers would find maximum information in this issue relevant and valuable to the sustainable management of forests. Van Sangyan welcomes articles, views and queries on various such issues in the field of forest science.

Looking forward to meet you all through forthcoming issues

Dr. Naseer Mohammad

Chief Editor

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Henna- The colouring herb of dry land areas

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Dry lands are characterized by low availability of rainfall or poor ground water sources leading to dependency on natural water sources for crop production. This type of farming leads to poor productivity and many times frequent crop loss due to drought. In such situations cultivation of food and commercial crops may affect the farmer's income directly. Best solution for this poor productivity and crop loss is by opting for alternate crops which are tolerant to abiotic stresses and also assured income generating. Among such type of crops henna is one important crop which can perform well under poor soil, less water and assured income generating crop.

Henna or *mehndi* (***Lawsonia inermis)*** is a perennial shrub belonging to Lythraceae family. When any rituals are considered especially the Indian marriages use of mehndi is compulsory. Trade name is based on word Hina which is Arabic name of the drug. It is also known as Mehndi (Hindi), Mendika, Rakthagarba (Sanskrit), Goranti (Telugu), Goravanti (Kannada), Mailanchi (Malayalam) etc. Henna is native toNorth Africa and Arabia.It is assumed that henna brought to the Indian sub-continent by the great Mogul king Babur.India, Egypt, Iran, Niger, Sudan and Pakistan are the important producers of henna leaves.

It is cultivated as an annual crop and rationing is commonly practiced by multiple harvesting due to its good regeneration ability. Leaves are the economic part of the plant and fragrant flowers also valued in perfumery. This plant is one of the oldest sources of plant dye known to man. It's leaves contain the reddish orange dye named lawsone (1.0 to 1.4% in dry leaves) that has been used as a cosmetic dye and also as textile dye until the discovery of synthetic dyes.Henna is known to have a soothing and cool effect on the skin and improve personal hygiene by checking fungal and microbial growth. Besides these, henna is also used as an ingredient in herbal medicines. In the Gulf countries, large-scale use of henna in burial rituals leads to high demand for unprocessed leaves as well (Phirke and Saha, 2013).

Fig. 1: Henna Plant, flower and fruits

Fig.2: Fresh Henna leaves

Henna grows throughout the India, though it is major commercial crop in Rajasthan, Gujarat, Madhya Pradesh and Punjab. Gujarat, Punjab and Madhya Pradesh henna is sold as hair dye whereas Rajasthani henna is best quality and used for body art quality. In the arid regions where arable cropping often ends in failure due to vagaries of monsoon, cultivation of henna gives some assured income to the farmers even under drought conditions. Owing to this reason there is a spurt in henna cultivation in the drought prone fields of Pali district (Singh *et al*, 2005)

Varieties

There are two botanical varieties are found in henna, one is *alba* which is pale or light yellow petals, and another is *rubra* which is having rose (red) petals. The alba types are cultivated in arid parts of Rajasthan as dye-crop and there are two types are recognized which are locally known as *desi* and *muraliya* type. The *desi* type has more foliage with a leafy canopy with larger green leaves. Whereas the *muraliya* type has a woody canopy, small leaves which are greyish green in colour. It flowers late as compared to early flowered *desi* types. The *desi* type is favoured for large scale cultivation due to higher leaf yield potential and the absence of pointed thorns made it easy for harvesting.

Soil and Climate

The growing environment or climate seems to play a major role in determining the leaf yield and dye content of henna leaves. It can be cultivated in very poor and marginal soils also. It requires well drained, deep, fine sandy or medium textured soil is best. However, for dye extraction purposesit requires sunny and dry weather for conducive for higher dye recovery. The henna growing areas in Rajasthan is 40-60cm deep sandy loam to clay loam soils with calcareous substratum with soil pH ranging between 7.7 and 9.9. areas which receive an average annual rainfall of about 450mm is optimum for its cultivation.

Nursery management

Henna plant can be propagated by seeds as well as vegetative means by stem cuttings. However, plants raised from seeds are preferred sue to better survival rate in the field condition. Henna seeds germinate slowly and germination is as less as 20 per cent due to presence of the hard seed coat. Therefore, seed treatment is required to break hard seed coat before sowing. For this seeds are pre-soaked in water for 8 to 10 days by changing the water daily. This pre-soaking results in 60-75 per cent germination in 10-15 days. Nursery beds done during March with the size of $30m^2$ and with one kg of seed are broadcasted by mixing with fine sand to ensure uniform sowing. The seed rate for one hectare is around 10kg to prepare seedlings transplanting. Flowering can be observed in nursery stage itself and this leads to poor vegetative growth. Therefore to maintain the vegetative vigour of seedlings, pinching of flower branches are practiced. In about 3-4 months the seedlings are suitable for transplantation in the field.

Planting

Nursery raised plants are transplanted during the rainy season in the month of July-August. Seedlings are given a cut at 10cm on the main stem and also roots to enable better establishment. The seedlings are drenched with anti-termite pesticide. The seedlings are transplanted at the spacing of 30 x 30cm in the field. Higher spacing of 45 x 30 cm provides scope for intercropping and also higher dry leaf yield. This spacing is also suitable for mechanical cultivation. Wider spacing of 2.0 x 1.0 m can be followed under agroforestry system.

Irrigation and nutrition

Henna is mainly grown as rainfed crop and requires very minimum water for life saving. If water is available irrigating crop once in 15-20 days gives 2-3 times higher leaf yield as compared to rainfed crop. Effective soil moisture conservation measures must be adopted to ensure long term moisture to crop. Frequent irrigations lower leaf yield and also dye content of leaves.

Crop is managed with minimum or no fertilizers even though it is cultivated in marginal soil with sand and gravelly nature. Application of 10-12 t of FYM per hectare is sufficient to get better leaf yield.

Harvesting and yield

Harvesting of henna starts after 1-2 years of planting and allowed to fully establish in field. If crop is maintained in bush form economic production starts from the 2-3 years after planting. Leafy branches are cut 10-12 cm above the ground using sharp heavy sickle, and wearing protective glove made of tough leather (Khandelwal *et al*., 2002). Ideal time for harvesting the herb with optimal dye content and quality of leaves the leaves or shoot is cut when the leaves are fully mature and yet retain their green colour. This is indicated by the starting of ripening of the capsules and also leaves on the main stems starts yellowing.

Under irrigated condition 70% more yield can be achieved as compared rainfed condition in main kharif harvest. Lesser yield may be obtained during November to March. Dye content in the herb can be improved by withholding water for 15 days prior to crop reaching physiological maturity. The average dry leaf yield under rainfed conditions is about one tonne per hectare; higher yield up to 2.5 t per hectare is obtained under irrigation.

Processing

In henna processing it is most important step to reduce the bulk of dry leaves followed by blending into various dyeing products. It generally leads to about 80-100 per cent value addition. In Pali district, Sojat city is the main processing hub of henna and it is found that more than 25 major and 100 small-scale industries are working on processing leaves. The leafy produce is first shredded into smaller pieces in a thresher and then reduced to fine powder by passing through the pulverizers, stone-burr or hammer mill. Leaf powder is graded and sometimes mixed with powder of jujube, khejri, or *Cassia auriculata* leaves.

Henna powder is used directly to prepare versatile products for hair dyeing, staining of palm and feet. Since henna is an acid mordant dye it is often blended with acidic ingredients like Indian gooseberry (aonla) to improve the dyeing capacity of the final product. Other beneficial herbs like *brahmi*, *shikakai*, *bhringraj*, mint, etc. may also be blended.

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Rajasthan Forest

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Introduction

As per the Champion & Seth Classification of Forest Types (1968), the forests in Rajasthan belong to two Type groups i.e. Tropical Dry Deciduous and Tropical Thorn Forests which are further divided into 20 Forest Types.The vegetation cover occupies 16.78% of the geographical area of the State. Of the total vegetation cover, forest area is contributing 4.71% of the geographical area. The main forest types of Rajasthan includes Dry Deciduous forest, Thorn forest, Broad leaved hill forest, Dhauk forest, Teak mixed forest, Riverine forest and grassland covers 2.87 % TGA. The vegetation type map prepared provides a key input for biodiversity understanding at landscapelevel.But for mapping and identification of habitats with different mixed vegetation types, single species dominated systems, locale specific formations and degraded types, the spatial resolution of 20-30 m are more appropriate; and thus, important for landscape scale studies of vegetation mapping.

Forest type

Broad leaved hill forest occupies 80.25 km^2 and unique to Mount Abu Wildlife Sanctuary of Sirohi district. Of the deciduous systems, mixed dry deciduous forest is dominant and occupies 10,443.81 km^2 followed by *Anogeissus pendula* (1354.13 km^2) and teak (456.03 km^2). Of the thorn vegetation system, mixed thorn forest represents 2252.16 km^2 followed by *Acacia senegal* (212.19 km^2) and *Prosopis cineraria* (72.12 km^2). Riverine forest is a locale specific vegetation type accounted for an area of 99.69 km^2. Agriculture is predominant land use in Rajasthan estimated as 250123.15 km^2 (73.08%) of TGA.

Forest type classification

Broad leaved hill forests

Broad leaved hill forests (Central Indian subtropical hill forests (8A/C3) of Rajasthan shows a mixture of evergreen and deciduous tree species. It is dominated by *Mangifera indica*, *Anogeissus*, *Lannea coromandelica* and *Syzygium cumini*. Total area covered by this forest is 80.25 km^2 (0.02% of total geographical area).

Dry deciduous forest

It is equivalent to northern dry mixed deciduous forests (5B/C2). This forest type shows prominence of *Anogeissus pendula*, *Butea monosperma*, *Lannea coromandelica*, *Boswellia serrata*, *Anogeissus lalifolia* and *Diospyros melanoxylon*. Dry Deciduous forests occupy major proportion under natural vegetation cover and predominantly found in Udaipur, Rajsamand, Ajmer, Kota, Baran, Chittorgarh districts. It occurs at an altitude of around 200-600 mts. It is spreading over an area of10,448.62 km^2 (3.05% of TGA).

Dhauk forest (6/E1)

This type is largely determined by the *Anogeissus pendula* which forms nearly pure crops, well stocked, about 6 m height. These forests are predominantly found in northern Aravallis, central Aravallis and east of Aravallis. The associated species are those of dry deciduous forests. The rainfall ranges between 500-900 mm. Area covered by this type is 1354.13 km^2 (0.13% of TGA).

Teak mixed forest (5A/C1b)

Teak Mixed Dry Deciduous Forests are found in Southern region of Rajasthan Dungarpur and Banswara districts. Area covered by this type is 456.03 km^2 (0.13% of TGA). The species composition in this type includes Tectona *grandis*, *Anogeissus lalifolia*, *Butea monosperma*, *Diospyros melanoxylon*, *Lannea coromandelica* and *Boswellia serrata*.

Thorn forest (6B)

It is equivalent to northern tropical thorn forests (6B). Thorn forests are mostly found in Thar Desert and central Aravallis of Rajasthan. Common species in this type are *Prosopis cineraria* (6B/C1), *Acacia senegal*, *Acacia nilotica*, *Acacia leucophloea*, *Acacia tortilis* and *Zizyphus mauritiana*. ***Capparis decidua***is indicator species of thorn forests in western Rajasthan.

Riverine (riparian) forest (5/1S1)

These are referred as dry tropical riverain forests. Riverine forests are interspersed indeciduous systems, wherever streams and rivers flow as surface channel over longer periods than surroundings.The species constituting such forests include *Terminalia arjuna*, *Syzygium cumini*, *Holoptelea integrifolia*and *Ficus racemosa*.

Woodland

It was referred as dry savannah forest (5/DS2). Depending on the mode of degradation, fire/grazing/edaphic conditions, the forest shows deterioration and becomes woodland. Based on the severity of disturbance, woodland of two types were common in Aravallis of Rajasthan and they are referred as Tree savannah and Shrub savannah.Tree savanna differs from shrub savanna only in tree height and spacing.

Scrub

Scrub is a vegetation cover predominantly occupied by shrubs or poor tree growth chiefly of small or stunted trees with crown density less than 10%. It is the first most dominant vegetation class covering an area of 31,471.61 km^2.

Grasslands

Grasslands of Rajasthan have been grouped into seven types. Swampy Grasslands (*Vetiveria-Saccharum*) are found among the marshes and fringes of wetlands in Bharatpur bird sanctuary.

Class	Area (km^2)	Area (%)
Forest		
Broad leaved hill forest	80.25	0.02
Dry Deciduous forest	10448.62	3.05
Thorn forest	2252.16	0.66
Sub total	12781.04	3.73
Gregarious formations		
Dhauk forest	1354.13	0.40
Teak Mixed forest	456.03	0.13
Riverine forest	99.69	0.03

Mixed Plantation	564.89	0.17
Grassland		
Saline Grassland	25.36	0.01
Swampy Grassland	2.80	0.001
***Lasiurus-Panicum* Grassland**	3339.45	0.98
***Cenchrus-Dactyloctenium* Grassland**	5430.01	1.59
***Aristida-Oropetium* Grassland**	80.15	0.02

Forest resource profile of Rajasthan

Rajasthan is the largest state of India has a geographic area of 342,239 sq. km and shows great variation in climate and vegetation and their natural resources. Here authors have tried to enlist major resources in tabulated form:

Forest area	**4.86 (16629.51 sq km)**
Very Dense	0.02 (77.81 sq km)
Moderately Dense	1.27 (4341.90 sq km)
Open Forest	3.57 (12209.80 sq km)
National park	05
Wildlife sanctuaries	25
Conservation Reserve	11
Project Tiger	03
Ramsar site	02 (Keoladeo and Sambhar lake)
Maximum forest area district	Udaipur (23.51%)
Minimum forest area district	Jodhpur (0.47%)
Maximum forest types cover area – 5B/C2	Northern Dry Mixed Deciduous(40.07 %)
Total tree species	65
Total shrub species	30
Total herb species	08
Growing Stock in Recorded Forest Area	24.39 m^3
Total Carbon stock of forests	108.36 MT (397.32 MT of CO_2 eq.)
Dominant tree species in TOF	*Prosopis cineraria* (Khejri)
Permanent pastures and other grazing lands	4.88 %

Radioactive contamination: Environmental issues

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The deposition of, or presence of radioactive substances on surfaces or within solids, liquids, or gases including the human body, where their presence is unintended or undesirable is known as Nuclear pollution, also called Radioactive contamination. Pollution of the atmosphere by radiation and radioactive particles is called nuclear pollution. Such contamination presents a hazard because of the radioactive decay of the contaminants, which produces such harmful effects as ionizing radiation (namely alpha, beta, and gamma rays) and free neutrons.

The degree of hazard is determined by the concentration of the contaminants, the energy of the radiation being emitted, the type of radiation, and the proximity of the contamination to organs of the body. It is important to be clear that the contamination gives rise to the radiation hazard, and the terms “radiation” and “contamination” are not interchangeable.

The sources of radioactive pollution can be classified into two groups: natural and man-made. Following an atmospheric nuclear weapon discharge or a nuclear reactor containment breach, the air, soil, people, plants, and animals in the vicinity will become contaminated by nuclear fuel and fission products.

Nuclear power reactors do not produce direct carbon dioxide emissions. Unlike fossil fuel-fired power plants, nuclear reactors do not produce air pollution or carbon dioxide while operating. However, the processes for mining and refining uranium ore and making reactor fuel all require large amounts of energy.

Nuclear power plants also have large amounts of metal and concrete, which require large amounts of energy to manufacture. If fossil fuels are used for mining and refining uranium ore, or if fossil fuels are used when constructing the nuclear power plant, then the emissions from burning those fuels could be associated with the electricity that nuclear power plants generate.

Radioactive pollution of water, water sources, and air space is the result of radioactive fallout from the cloud of a nuclear explosion. Radionuclides are the main sources of pollution; they emit beta particles and gamma rays, radioactive substances.

Rapid nuclear energy from radioactive fuels is used to heat water into steam. Steam is then used to turn on the turbines which in turn act as generators to produce electricity. A small amount of radiation is released into the water during this process, which can then be the cause of nuclear pollution.

Spent nuclear fuel consists of very active radioactive atoms that sometimes last for about 600yrs or more. These should be dealt with very carefully, with strict rules in well-specified locations. Some plants spent fuel in underground water pools because they release a high amount of heat and need to be cooled. There is always a danger of contaminating the groundwater and the surrounding land, seeping into the nearby land.

Mining mostly involves the excavation of the mineral ores, which are then broken into smaller, manageable pieces. Radium and Uranium, for instance, are naturally occurring in the environment and are equally radioactive.

Hence, mining increases the natural geological processes by moving these materials from underneath the earth to the surface. Other minerals with a hint of radiation are thorium, plutonium, radon, potassium, carbon and phosphorus.

The radioactive wastes are of three categories- high level, low level and transuranic. They mainly comprise of the disposal from nuclear weapons, the cleaning materials from nuclear plants, military installations, emitted from plutonium processing and other radioisotopes from hospitals and laboratories.

The handling and disposal of nuclear waste may generate low to medium radiation over a long period of time. Their effects are not only hard to predict but may not be easily distinguishable as the radioactivity may contaminate and propagate through air, water, and soil as well. Moreover, identifying locations of some nuclear waste is not easy.

The main issue is that the radiation waste cannot be degraded or treated chemically or biologically. The only options are either to contain the waste storing in tightly closed containers shielded with radiation-protective materials (such as Pb) or dilute it.

It can also be contained by storage in remote areas with little or no life like remote caves or abandoned salt mines. However, natural or artificial whatever shields are used may get damaged over time.

Moreover, waste disposal practices in the past may not have used appropriate measures to isolate the radiation. Therefore, those areas need to be identified carefully, and restrictions promptly imposed.

The effect of nuclear pollution is seen on every organism in the environment, from bacteria to plants to humans. Nothing spared.

Experience radiation sickness, closest to and closest to the source. There is a high risk of 300 REM and more changes in blood cells and bleeding. There is the loss of hair above 600 REM, immune loss usually ranges from a few days to weeks. Radiation causes changes in the body's cell and gene structure, such as the bone marrow, skin, intestine, lymphoid tissue, and fetus.

Those exposed from far away may not see any immediate symptoms. But various forms of cancer tend to develop and have a shorter life span. Radiation also causes cell mutations that can be transferred to the next generation.

The fetus is affected by birth defects and cancer. Their lifespan may also be shorter.

Plants die and show some genetic changes and enhanced growth. Animals are also affected and do not survive very long.

Radiation will not dissolve quickly in the atmosphere. Every water source will also be affected. In fact, it may take years or centuries to reach a point where such a place may be habitable.

An average person will be exposed to about 180 millilitres of radiation a year through exposure to natural radiation, medical and dental X-rays, colour TV, airport baggage X-rays, etc.

Radiation has adverse effects when it comes to genetics. It leads to damage to DNA strands leading to the genetic break up over time. The degree of genetic mutation leading to changes in DNA composition varies due to the level of radiation one has been exposed to and the kind of exposure.

In the event that a human or an animal is exposed to too much radiation from the atmosphere, the food consumed, and even water used then, the chances are that their bodies have already absorbed the radiation. Once in the body, it remains active because energy cannot be destroyed.

The resulting mutation makes one highly susceptible to cancer. For pregnant women, kids born have adverse defects caused by genetic mutations like low weight during birth. Effects such as disfigured births and impairment like blindness in children have also been reported. Infertility has also been mentioned as an effect of radiation.

Exposure of radiation to the atmosphere means it is present even in soils. Radioactive substances in the soil react together with the various nutrients leading to the destruction of those nutrients, thus rendering the soil infertile and highly toxic.

Such soil leads to the harvest of crops that are riddled with radiation and thus, unfit for consumption by both humans and animals.

Plants that grow from such soil are also genetically modified. Since these are at the base of the food chain, the herbivores consume them and retain the radiation levels. The carnivores such as lions, vultures end up consuming them and increasing their levels of radiation – explained through the concept of Biomagnification.

Radioactive pollution has diverse effects, such as the alteration of cells. The bodies of living organisms are unique as within it, there are millions of cells in one single body, where each has its own purpose to fulfill. Radiation distorts the cells present, leading to permanent damage of the various organs and organ systems. In the face of too much radiation, permanent illnesses and death are inevitable.

The animals at different levels suffer differently. The higher-level organisms get more affected than insects and flies. Herbivores, such as cattle, when grazing the contaminated land, the deposited Ce-13 and I-131 get accumulated on the animal tissues in a large amount.

These radionuclides enter their metabolic cycles and affect their DNAs (mentioned above; ionizing). This ends up having a mutated animal generation with a higher risk of health issues by just a small amount of radionuclides.

The plants are also exposed to radiation, and the damage is mostly done due to the increased Ultraviolet waves. Different plants get affected differently.

The stomata stop to evaporate during the increase of radiation. When the radiation hits the chromosomes, the reproduction gets hampered. It results in altered shapes, sizes and health in plants. Exposure in high amounts destroys the affected plants. When we eat these plants, we ingest nuclides.

The power plants, which are the sources of nuclear energy and chemical processing, have been releasing radioisotopes into the water for decades. Cesium, Radon, Crypton, Ruthenium, Zinc and Copper are few of them. Though the waste is released in a “permissible” amount, it does not mean safe.

These radionuclides can be detected in the soft tissues or on the bones of the fishes. The sea-weed used in bread was said to have radioisotope of ruthenium. The shells of all shelled fishes and the tissues of fishes are contaminated with radionuclides.

The right safety gear, such as a lead apron, must be worn while undergoing X-rays or radiation therapy procedures. It also includes pregnant women. It is also mandatory to use lead sheathed walls in imaging facilities.

As a person, one should be aware of the dangers of nuclear pollution. If living in the vicinity of a nuclear plant or planning someone’s planning, the person’s authority should be exercised to ensure that the governing body for the manufacture, implementation, and disposal of waste is fully planned Have been. Ensure that officers are prepared in the event of a disaster so that they can handle all situations such as arranging evacuation to avoid contamination.

Workers are always monitored for the amount of radiation they were exposed to while working at a radiation facility or a nuclear plant.

Radioactive waste can actually be recycled to a great extent as useable fuel is still being made into useless materials that can later be reclaimed.

Governments are authorizing research on developing better means for the disposal of radioactive waste. The most viable method now appears to be deep underground storage of waste.

Power plants must ensure that radioactive fuel and waste are transported and disposed of in safe containers that are long-lasting and unbreakable.

Operating agencies need to ensure that radioactive material does not fall into the wrong hands, which they sell for profit to those in the waging war business.

Radioactive waste still has some level of radiation. Accordingly, it cannot be disposed of in the same way as normal waste. It cannot be incinerated or buried. Since there is a likelihood of seepage, this waste should be stored in heavy and thick concrete containers.

Another option is to dilute the radiation since storage may not be possible. Since there are no easy ways of disposing of radioactive material, professional assistance should always be sought.

It is necessary for any material with radioactive content to be labeled, and the necessary precautions advised on the content of the label. The reason for this is because radiation can enter the body by a mere touch of radioactive material. Containers with such elements should be well labeled in order to make one use protective gear when handling them.

The evolution and use of nuclear power was not a bad thing initially. However, considering the damage and threats it has on the environment, it is high time for its use to be discontinued and for the world to perhaps focus on alternative and environmentally friendly energy sources – like renewable sources of energy namely solar, hydro-electric and wind power.

The use of radioactivity to generate energy in nuclear power plants, for example, leads to the production of more radiation to the atmosphere considering the waste released from the various processes and combustion.

Since it is not easy to store or dispose the waste, it can be recycled and used for other purposes like in another reactor as fuel thereby protecting the environment.

There may be the possibility of contamination if one owns a house located near a nuclear power plant. In that case, it is recommended to check the level of radon gas in your building. The radon level needs to be removed. Those who work with radioactive material are also at great risk. They need protective measures to keep away from radioactive contamination.

Role of fuelwood and its substitute

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Introduction

Fuelwood is any type of wood that is used as a fuel for cooking, heating, or powering steam-powered engines or turbines to generate electricity.It is an important source of energy in both developing and developed countries. It is a necessary input for all productive economic activity and satisfies the fundamental energy requirements in both home and traditional rural industries (Vimal and Tyagi, 1984). In the majority of rural Indian families, fuelwood is a significant source of cooking energy. In rural Indian families, biomass accounts for roughly 84 percent of overall energy usage, with fuelwood being the most common kind (Patil, 2010). Because of its great thermal efficiency, which significantly lowers cooking time, and the unavailability of alternative biofuels, fuelwood has a high dependency among biomass fuels (World Bank, 2004). The Forest Survey of India's fuelwood consumption studies in forested portions of the nation, particularly in the forest-rich states of Arunachal Pradesh, Madhya Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura, also show high consumption rates. Despite the fact that fuelwood is the primary source of energy for 70% of India's population, there is still a knowledge gap on the fuelwood situation. Over 77 percent of rural families in the nation were expected to rely on firewood and chips for cooking, with only 7% using dung cake and 9% using LPG.

Nearly 62 percent of families in urban areas utilised LPG as their major source of energy, while 20% used firewood and chips (NSSO 2007-08). There are differences in home energy usage between rural and urban residents, as well as between highand low-income groups. Despite substantial expansion in the business sector, demand for fuelwood has soared. Forests were once thought to be the primary source of fuelwood. The area of fuelwood production has increasingly migrated from forest to non-forest regions since the introduction of social forestry and large-scale afforestation programmes. Acacia spp, Prosopis spp, Eucalyptus spp, Tamarindus spp, Casuarina spp, etc. are the most common fuelwood species in India. In 1996, the country's total fuelwood consumption was 201 million tonnes, or 213 kilogrammes per inhabitant per year. The present sustainable fuelwood production from forests is 17 million tonnes, with 98 million tonnes coming from agriculture forestry and other regions. Women in the Indian society collect fuelwood for cooking energy without spending any money and as a result, they are subjected to a variety of strains and risks. The most common source of deforestation in developing nations is the collecting of fuelwood. Cooking with fuelwood is a major source of indoor air pollution. Fuelwood demand for cooking and heating is frequently listed as the leading driver of deforestation, ahead of other forest products such as furniture and paper. In recent years, the assumption that fuelwood exploitation constitutes a forestry issue has been questioned more and more. As a result of the diversification of supply sources, forest degradation and deforestation are no longer linked to unsustainable fuelwood exploitation. Forests have been relieved of strain due to increased dependence on non-forestry sources and flexibility in home fuel consumption. Fuelwood has traditionally come mostly from the forest, although it is increasingly coming from non-forest sources. Outside of forests, such as scrub, bush fallow, dead wood, pruning, and lopping, a lot of fuelwood is now collected.

Trees planted along highways, canals, farmlands, and wastelands are now producing a lot of fuelwood. Further government attempts to protect biodiversity and current forest resources have resulted in an expansion in restricted zones where fuelwood harvesting is prohibited. Fuelwood will be generated from outside forests, remote forestry, common wastelands, and agroforestry, as area is unlikely to grow owing to competition with agriculture and other land uses. The major goal of the social forestry phase in the 1980s was to relieve strain on natural forests by supplying fuelwood and other wood products to the local community from outside forest regions. Fuelwood will be generated from outside forests, remote forestry, common wastelands, and agroforestry, as area is unlikely to grow owing to competition with agriculture and other land uses. To decrease firewood waste and transportation costs, firewood might potentially be produced closer to consumption hubs. As a result, firewood farming should be established as a business to satisfy India's anticipated firewood shortage. The majority of the fuel wood is acquired from marketplaces by urban residents (60 percent), with the balance coming from roadside plantings (30 percent) and farmland. The majority of rural inhabitants' fuel wood demand (75%) is fulfilled by collecting from roadside plantings, while the remaining 25% is supplied by collecting from forests. However, given the exponential growth of people in tropical nations, it is desirable to use, maintain, and manage the forest in a sustainable manner to ensure its proper usage. Alternatively, fostering tree planting projects of popular species in non–forest regions by including the community will relieve forest demand for firewood extraction.

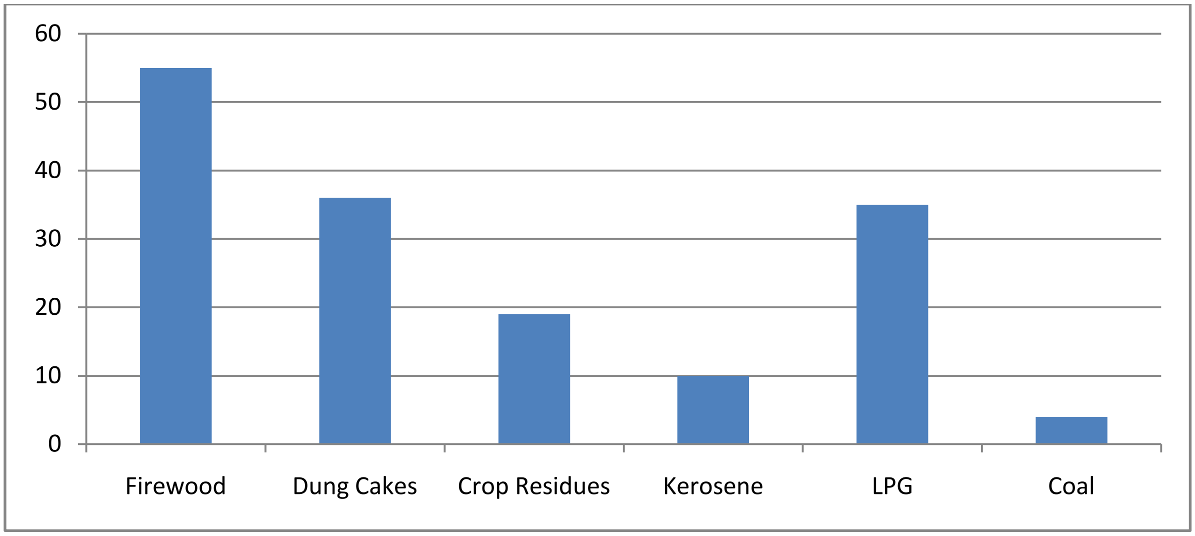

Fig. 1. Various Fuels Used for Cooking based on IHDS II data (2011-12)

Implications of using fuelwood

However, there are major negative repercussions for health, the environment, and economic growth when resources are collected in an unsustainable manner and energy conversion technologies are inefficient. Every year, around 1.3 million people largely women and children die prematurely as a result of indoor air pollution caused by biomass. Fuelwood gathering takes up a lot of time and effort, which could be better spent on schooling or earning money. There may also be environmental consequences, such as soil deterioration and regional air pollution.

Alternatives to fuelwood

The Indian government announced in 2017 that federal subsidies for LPG (Liquefied Petroleum Gas) a fuelwood replacement will be phased out sparking worries that this would increase fuelwood consumption and negatively damage indoor air quality.

Agricultural residues, when combined with proper energy conversion technology, offer only limited options for fuelwood/charcoal replacement, and this is not always practicable without compromising their alternative use in order to preserve agricultural production.

Fossil fuels, such as gas and kerosene, are more practical, especially for domestic usage in metropolitan settings. However, despite the introduction of substantial subsidies, their utilization has been difficult to execute for a variety of technological, economic, and cultural reasons.In general, briquetting has shown to be a successful method in a number of projects in developed countries. Tax incentives or the high cost of petroleum fuels have made briquettes not only technically but also economically feasible in some circumstances. However, because to the restricted number of areas where briquettes may be viable and the scarcity of adequate raw materials, there has not been a general growth of briquetting.Biogas was also suggested as a viable alternative to fuelwood. Major advancements in the efficiency and dependability of both small and large-scale biogas systems have been made thanks to significant research efforts. Many nations have biogas initiatives underway only time will tell if its widespread adoption as a fuelwood/charcoal alternative will be effective.

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Occurrence of *Ophiusa tirhaca* in sal forests of Kanha Tiger Reserve

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Abstract

The present article reports the occurrence of an insect defoliator, *Ophiusa tirhaca* Cramer (Lepidoptera : Noctuidae) in sal (*Shorea robusta*) forests of Kanha Tiger Reserve, Mandla Forest Division, Madhya Pradesh. The pest profile has been described.

Key words: Sal, *Shorea robusta*, defoliator, *Ophiusa tirhaca*, Kanha Tiger Reserve, Madhya Pradesh

Introduction

Kanha Tiger Reserve lies between $22^0 07'$-$22^0 27'$N and $80^0 26'$-$81^0 03'$E and is located in the Maikal ranges of the Satpura, falling in Mandla and Balaghat districts of the state of Madhya Pradesh (Buch, 1991). There is a wide spectrum of vegetation due to broad topographic features involving 'dadars' on hilltops falling via upper steep slopes to the narrow and wide valleys at different levels (Maheshwari, 1964). The sal, *Shorea robusta* Gaertn.f. (family Dipterocarpaceae) forests usually occupy the low hills, the lower slopes of higher hills and it forms 80% to nearly 100% of the crop (Lal et al., 1986).

Sal has the highest number of insect fauna among the forest trees. Of about 346 insects recorded on sal, about 155 species are associated with living tree, encompassing mainly defoliators (108), borers (20), seed-feeders (17) and sap-suckers (4) (Stebbing, 1914; Beeson, 1941; Mathur and Singh, 1960; Browne, 1968; Singh and Thapa, 1988; Sen-Sarma and Thakur, 1994; Tewari, 1995; Thakur, 2000; Nair, 2007; Roychoudhury et al., 2007; Joshi et al., 2008; Roychoudhury, 2015, 2017). Rest of the insects feed either on the freshly felled timber or dry timber, including insect species feeding on decaying or rotten wood of sal. Joshi et al. (2004a, b) have studied insect faunal composition of Kanha National Park and reported 187 species of insects, out of which 51 species of butterflies, 88 species of moths, 20 species of beetles, 8 species of grasshoppers, 6 species of bugs, 5 species of bees, wasps and ants, 4 species of crickets, 4 species of mantids and one species of termite. The present article deals with the pest profile of *Ophiusa tirhaca*, an insect defoliator of *S. robusta*, collected from sal forests of Kanha Tiger Reserve, Mandla Forest Division, Madhya Pradesh.

Pest profile

Ophiusa tirhaca Cramer (Lepidoptera : Noctuidae)

Ophiusa tirhaca (syn. *Anua tirhaca*) is commonly known as the green drab. This species is found in India, China, Japan, Philippines, Australia, Europe, Africa, Madagascar and Hong Kong (Shubhalaxmi et al., 2011; Gurule, 2013).

The species was first described by Pieter Cramer in 1777 (Savela, 2019). The diagnostic features of this moth are : head and thorax is greenish yellow; abdomen orange, fore wing greenish yellow with slightly darker striae; an indistinct outwardly oblique antemedial line meeting a sinuous inwardly oblique postmedial line arising from a dark spot on the costa at inner margin; the orbicular a dark speck; reniform brown; an irregularly dentate submarginal line with two black subapical lunules on it; the area beyond it reddish; a crenulate marginal line (Gurule, 2013). Hind wing orange with broad submarginal black band not reaching costa or inner margin and sometimes almost obsolete. The wing span varies from 70-73 mm.

Fig. 1. Adult moth of *Ophiusa tirhaca*

The adult is a fruit-piercing moth, which is recorded as a pest of citrus in Rhodesia (Evans, 1952) and Ghana (Forsyth, 1966), and of *Schinus molle* in Kenya (Le Pelley, 1959). The larvae, which are semi-loopers, are polyphagous on the foliage of dicotyledonous trees, such as *Shorea robusta*, *Terminalia bellerica* and *T. tomentosa* have been recorded as hosts of the larvae in India (Beeson, 1941), and in Nigeria, where the species occurs in the Guinea savanna, they have been responsible for occasional defoliation of young *Eucalyptus camaldulensis* (Browne, 1968). Berlinger et al. (2021) have recorded *O. tirhaca* moths throughout the year in Israel, with a peak in July-August. There are three overlapping generations in a year. The larvae occasionally cause severe damage to leaves of young pistachio trees and they are difficult to detect during the day, being closely attached to the branches and resembling them in shape and colour.

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